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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Before United States Patent Application of:

Applicant: DONATUCCI et al.

Application No.: 10/022,298

Date Filed: December 18, 2001

Title: DECABORANE DELIVERY
SYSTEM

Docket No.: 2771-514

Examiner: BUEKER, Richard R.

Art Unit: 1763

Confirm. No.: 1697

Customer No.:

25559

DECLARATION UNDER 37 CFR §1.131 IN U.S. PATENT APPLICATION NO. 10/022,298

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

MATTHEW B. DONATUCCI, LUPING WANG and JAMES J. MAYER hereby declare:

1. THAT we are co-inventors of the subject matter disclosed and claimed in United States Patent Application No. 10/022,298 filed December 18, 2001 in the United States Patent and Trademark Office in the names of Matthew B. Donatucci, Luping Wang, James J. Mayer and entitled, "DECABORANE DELIVERY SYSTEM," hereafter referred to as the "Application."
2. THAT the Application discloses and claims a system for a vaporizer and delivery system having multiple elongated wells to provide increased surface area for vaporization of liquids and solid materials used in ion implantation and chemical vapor deposition processes, and that the Application broadly claims such a system in the following claim 1:
 1. A vaporizer comprising:
a thermally conductive block comprising a top surface and bottom surface and a multiplicity of non-moving elongated wells formed

therein for placement of a vapor source material, the multiplicity of elongated wells communicatively connected to an interior space within the thermally conductive block for accumulation of vapor, wherein each elongated well consists of a closed end and single opening that is in fluid communication with the interior space, and wherein each elongated well is vertically positioned relative to the top and bottom surface of the conductive block;

a heating device for applying heat to the multiplicity of the elongated wells within the thermally conductive block;

a removable sealing lid positioned on the top of the thermally conductive block for sealing the thermally conductive block to form a closed vessel and removable for ease of filling the elongated wells; and

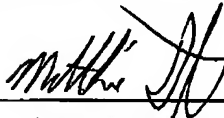
an openable and closable outlet for discharge of vapor formed in the vaporizer communicatively connected to the removable sealing lid and the interior space.

3. THAT we are aware that the Application has been examined by the United States Patent and Trademark Office and the claims of the Application have been rejected on various grounds including the disclosure of Spahn, U.S. Patent No. 6,237,529 which has an effective filing date of March 3, 2000.
4. THAT Exhibit 1 attached herewith is a true and exact copy of pages 1-5 of an Invention Disclosure wherein page 2 has been included twice, once signed and once unsigned so that the Examiner has a clear picture of the apparatus discussed therein, that the unsigned page 2 is not part of the original Invention Disclosure but included in the Exhibit to provide a clear picture of the apparatus and is part of this Declaration, and that all experiments and acts discussed in the Invention Disclosure were conducted in the United States before the Effective Date of March 3, 2000, which is the filing date of Spahn (U.S. 6,237,529).
5. That all the all dates have been blacked out in the attached Invention Disclosure, but all dates are prior to the Effective Date of March 3, 2000, which is the filing date of Spahn (U.S. 6,237,529); that the title of the document is "Decaborane Delivery System;" that page 1, first paragraph, fourth sentence discusses the "[t]he internal reservoir is made up of many deep, cylindrical wells. The small cylindrical wells dramatically increase the surface area to contact the solid, therefore more decaborane is vaporized.;" that page 1, middle paragraph discusses "[t]he system also has to be heated evenly over its geometry in order to prevent

decaborane from condensing in a 'cold' spot;" that page 2, top paragraph discusses "[t]he lid and valve, which is one piece, is sealed to the block with a viton o-ring and machine screws;" and that on page 2, top paragraph discusses "[a]top the aluminum block is a shut off valve...which provides good conductance for decaborane flow."

6. THAT we offer Exhibit 1 with this Declaration as evidence of the completion and possession of the integrated treatment system disclosed and claimed in the Application prior to the Effective Date of March 3, 2000, which is the filing date of Spahn (U.S. 6,237,529);

As a below-named declarant, I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements, and the like, so made are punishable by fine or imprisonment, or both, under Section 1001 or Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



MATTHEW B. DONATUCCI

Date 10/7/05

LUPING WANG

Date _____

JAMES J. MAYER

Date _____

decaborane from condensing in a 'cold' spot;" that page 2, top paragraph discusses "[t]he lid and valve, which is one piece, is sealed to the block with a viton o-ring and machine screws;" and that on page 2, top paragraph discusses "[a]top the aluminum block is a shut off valve...which provides good conductance for decaborane flow."

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MATTHEW B. DONATUCCI

Date _____



LUPING WANG

Date 9/30/05

JAMES J. MAYER

Date _____

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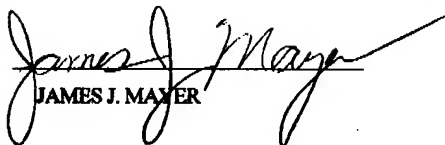
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MATTHEW B. DONATUCCI

Date _____

LUPING WANG

Date _____


JAMES J. MAYER

Date 9/27/05

INVENTION DISCLOSURE

ROI Number [REDACTED]

Short, Descriptive Title: Decaborane Delivery System

- (1) State the PROBLEM or DEFICIENCY which is overcome by your invention:
 Decaborane is a solid with a vapor pressure of ~0.2 torr at room temperature. To increase the vapor pressure, heat must be supplied to its container. The evaporation rate of the decaborane in the vaporizer is significantly enhanced by its internal geometry. The internal reservoir is made up of many deep, cylindrical wells. The small cylindrical wells dramatically increase the surface area to contact the solid, therefore more decaborane is vaporized.
- (2) Describe clearly the INVENTION, RESULTS, ADVANTAGES. (Make DRAWINGS when possible and DESCRIBE FULLY the invention and its OPERATION using REFERENCE NUMERALS to indicate elements.

A system was needed to provide a constant deliverable flowrate of decaborane to an ion source chamber. Decaborane is a white solid with a vapor pressure of ~0.2 torr at 20°C. The system has to be heated in order to generate enough vapor to induce flow to the source chamber. The system also has to be heated evenly over its geometry in order to prevent decaborane from condensing in a "cold" spot. All lines leading from the delivery system to the ion source chamber must also be heat traced for the same reason.

The system hardware is comprised of an aluminum block 2.5" W x 2.5" L x 5" H with a total internal volume of ~160 cc. The solid holding wells consist of 3/16" ID holes bored into the block and their total volume is ~60 cc. The remaining 100 cc is

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Matt Dornice
 (Signature)
Matt Dornice
 (Print Name)
[REDACTED]
 (Date)

 (Signature)

 (Print Name)

 (Date)

 (Signature)

 (Print Name)

 (Date)

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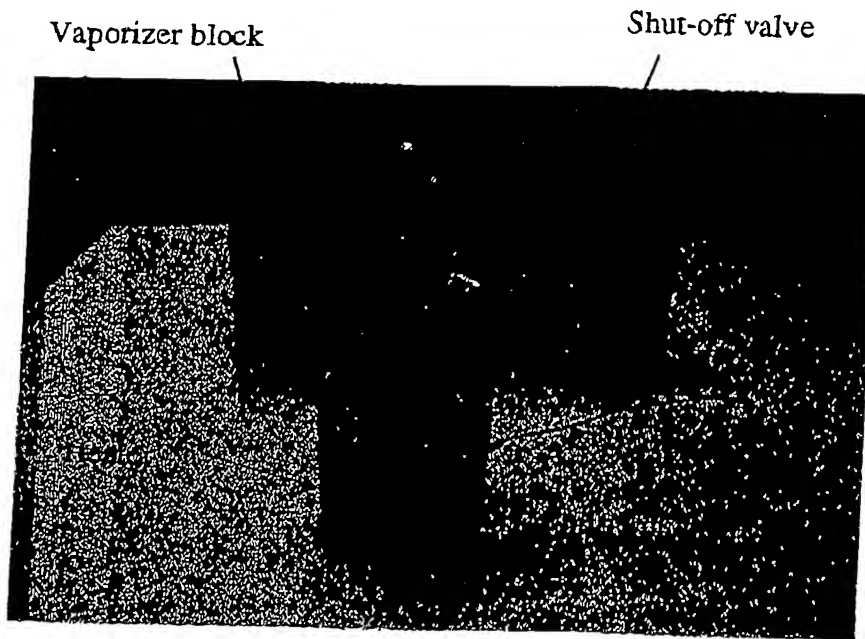
[Signature]
 (Signature - Full Name)
OLIVER ZITMAN
 (Print or Type Full Name)
[REDACTED]
 (Date)

 (Signature - Full Name)

 (Print or Type Full Name)

 (Date)

bored out above the reservoirs and serves as a void space for the solid vapor to accumulate. Atop the aluminum block is a shut-off valve and block lid. The stainless steel shut-off valve has a 7.6 mm orifice which provides good conductance for decaborane flow. The lid and valve, which is one piece, is sealed to the block with a viton o-ring and machine screws. A picture of the hardware is shown below.



The reservoir block and shut-off valve are heated by 10 watt resistors. Four resistors are placed on each vertical face of the block and two are placed on the side of the valve block. When current is supplied to the resistors, they heat up and increase the temperature of the vaporizer and valve. The aluminum vaporizer provides excellent thermal conductivity and therefore a uniform temperature profile throughout. The temperature of the vaporizer can be controlled with a temperature controller, 50 watt power supply (2 amp max current) and a solid state relay. A wiring diagram is shown below:

INVENTOR(S):

Matt Doster

(Signature)

Matt Doster

(Print Name)

[Redacted]

(Date)

(Signature)

(Print Name)

(Date)

(Signature)

(Print Name)

(Date)

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(Signature - Full Name)

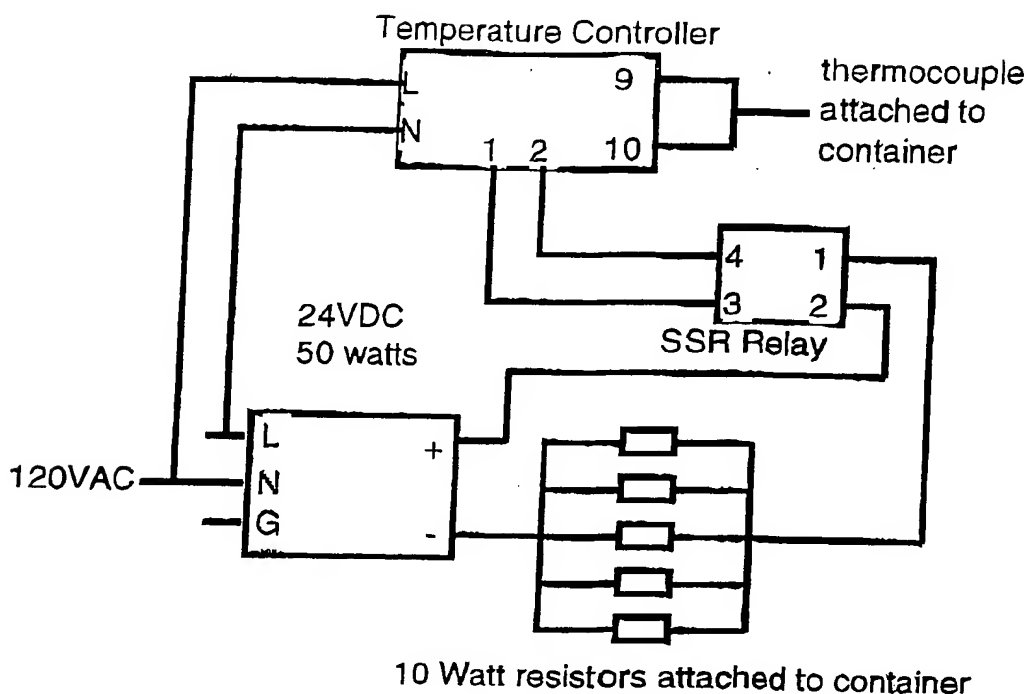
(Print or Type Full Name)

(Date)

(Signature - Full Name)

(Print or Type Full Name)

(Date)



Depending on the desired temperature, the temperature controller sends a signal to the power supply, through the relay, to either provide more current to the resistors or to power down the resistors. A surface mount type K thermocouple is connected to one of the vertical faces of the block. The maximum external temperature of the resistors is $\sim 120^{\circ}\text{C}$ with a 2 amp max current power supply.

Once testing is over, it is important to continue to supply power to the resistors on the shutoff valve and to cut power to the resistors on the vaporizer block. This will prevent the decaborane from condensing in and clogging the inlet to the shut-off valve. The decaborane vapor will instead re-condense in the cooler vaporizer block.

INVENTOR(S):

Matt Decker
(Signature)
Matt Decker
(Print Name)
[Redacted]
(Date)

(Signature)

(Print Name)

(Date)

(Signature)

(Print Name)

(Date)

READ AND UNDERSTOOD BY:

[Signature]
(Signature - Full Name)

(Print or Type Full Name)
[Redacted]
(Date)

(Signature - Full Name)

(Print or Type Full Name)

(Date)

Test data shows that sustainable flowrates of decaborane can be achieved with this system. Tests were conducted using various system temperatures and various orifice diameters. The maximum achievable flowrates are as follows (all temperatures reflect that of the vaporizer):

Through 1/4" OD straight tubing:

@42 C - 0.6 sccm

@52 C - 2.8 sccm

@66 C - 5.1 sccm

Through 1/8" OD straight tubing

@42 C - 0.1 sccm

@52 C - 0.8 sccm

@66 C - 3.6 sccm

Using a Needle valve

@66 C - 0.35 sccm (Cv = 0.004)

@66 C - 4.0 sccm (Cv = 0.055)

- (3) Was this invention first conceived or first actually reduced to practice under government contract support? If so, what are the contract name and contract number?

No

- (4) Has there been any publication, public disclosure, or offer for sale, or are any contemplated? Provide details, especially dates.

There is a plan to offer this product for sale as soon as possible. We have sent a prototype to Eaton for testing and are going to send another to NJIT (by

INVENTOR(S):

Matt Doherty

(Signature)

Matt Doherty

(Print Name)

(Date)

(Signature)

(Print Name)

(Date)

(Signature)

(Print Name)

(Date)

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[Signature]

(Signature - Full Name)

(Print or Type Full Name)

(Date)

(Signature - Full Name)

(Print or Type Full Name)

(Date)

end of the month). A small presentation regarding this product is planned for next months ion implant users group meeting. A brochure to introduce this product is currently in the design stage.

- (5) Laboratory Notebook or Runsheet Number cross reference, including date(s).

Laboratory notebook [redacted] all decaborane research starting on [redacted]

INVENTOR(S):

Matt Donahue
(Signature)
Matt Donahue
(Print Name)
[redacted]
(Date)

(Signature)

(Print Name)

(Date)

(Signature)

(Print Name)

(Date)

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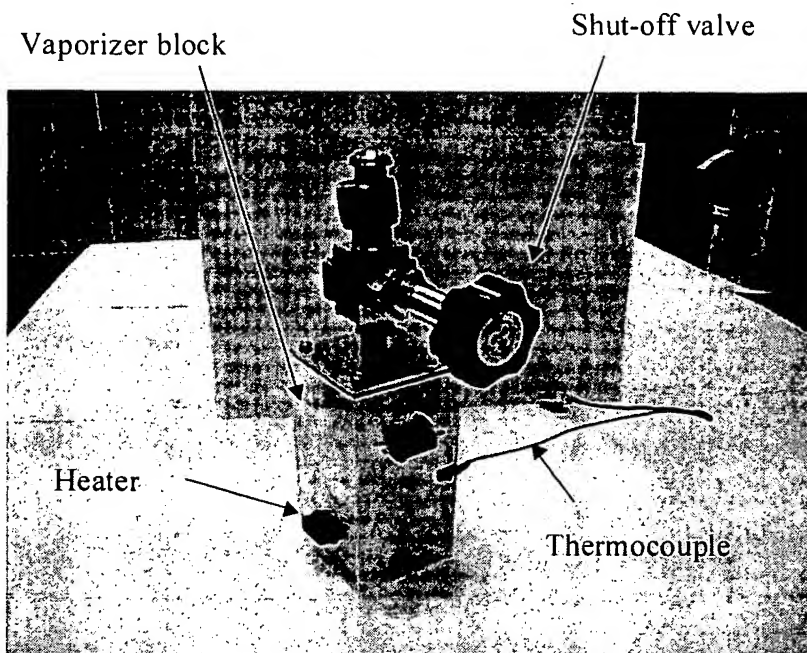
(Print or Type Full Name)
[redacted]
(Date)

(Signature - Full Name)

(Print or Type Full Name)

(Date)

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_____ (Signature)	_____ (Signature)	_____ (Signature)
_____ (Print Name)	_____ (Print Name)	_____ (Print Name)
_____ (Date)	_____ (Date)	_____ (Date)

READ AND UNDERSTOOD BY:

_____ (Signature - Full Name)	_____ (Signature - Full Name)
_____ (Print or Type Full Name)	_____ (Print or Type Full Name)
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